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A RAND NOTE

The Robust Separation Projection Method for Predicting Monthly Losses of Air Force Enlisted Personnel

Marygail K. Brauner, Daniel A. Relles

RAND

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Prepared for the
United States Air Force

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PREFACE

RAND is helping to design an Enlisted Force Management System (EFMS) for the Air Force.[1] The EFMS is a decision support system designed to assist managers of the enlisted force in setting and meeting force targets. The system contains computer models that project the force resulting from given management actions, so actions that meet targets can be found. Some of those models analyze separate job specialties (disaggregate models) and others analyze the total enlisted force across all specialties (aggregate models); some models make annual projections (middle-term models) and others make monthly projections.

The Short-Term Aggregate Inventory Projection Model (SAM) is the component of the EFMS that makes monthly projections (for the rest of the current fiscal year) of the aggregate enlisted force. The overall SAM model contains five modules:

Module P: Preprocessor.
Module 1: Separation Projection.
Module 2: Inventory and Cost Projection.
Module 3: Computer Aided Design.
Module 4: Plan Comparison.

SAM is documented in C. Peter Rydell and Kevin L. Lawson, *Short-term Aggregate Model for Projecting Air Force Enlisted Personnel (SAM),* RAND, N-3166-AF, 1991. That Note gives detailed specifications for modules P and 2 through 4. Module 1 (the Separation Projection module) projects monthly loss and reenlistment behavior. The detailed specifications for alternative versions of Module 1 are presented in separate publications. These describe three promising methods of predicting the separations required from Module 1:

[1]For an overview of the EFMS see Grace Carter, Jan Chaiken, Michael Murray, and Warren Walker, *Conceptual Design of an Enlisted Force Management System for the Air Force*, RAND, N-2005-AF, August 1983.

- Time series forecasting.
- Robust separation projection.
- Benchmark separation projection.

All three methods predict the monthly losses and reenlistment flows that are needed as inputs to Module 2. They predict "policy-free" flows--the losses and reenlistments that would occur in the absence of early release and early reenlistment programs. (Module 2 accounts for the effect of past and present management actions on losses and reenlistments.) However, in spite of having the same objectives the three methods differ fundamentally in the way they accomplish those objectives.

The time series forecasting method uses models such as constant rate, regression, autoregressive, and straight line running average. These models are documented in Marygail K. Brauner, Kevin L. Lawson, William T. Mickelson, Joseph Adams, and Jan M. Chaiken, *Time Series Models for Predicting Monthly Losses of Air Force Enlisted Personnel,* RAND, N-3167-AF, 1991.

The robust separation projection method uses data on past losses and reenlistments to estimate separation rates for a model that predicts loss and reenlistment flows one month at a time for each of a mutually exclusive set of about 500 cohorts. After these flows are predicted for a projection month, the inventory is updated and the models are applied to the updated inventories to predict the flows for the following month. This process is repeated until the inventory for the last month of the fiscal year is projected. Thus, it applies separation rates to a series of different inventories. The robust method is specified in this Note.

The benchmark separation projection (BSP) method uses data on past losses and reenlistments to estimate a set of separation rates for each month of the fiscal year for a mutually exclusive set of about 280 "decision groups." Those separation rates are then applied to the current inventory to predict monthly loss and reenlistment flows for the rest of the fiscal year. Thus, the BSP method applies different sets of separation rates to a single inventory (that single inventory is the

inventory at the start of the projection period). The BSP method is documented in C. Peter Rydell and Kevin L. Lawson, *The Benchmark Separation Projection Method for Predicting Monthly Losses of Air Force Enlisted Personnel*, RAND, N-3168-AF, 1991.

The names "robust" and "benchmark" are historical artifacts. "Robust" refers to a particular method of averaging past separation rates that is not unduly influenced by outliers in the historical data. "Benchmark" refers to the method's original purpose: to serve as a standard of comparison for the accuracy, reliability, and runtime of alternative methods for Module 1. The benchmark model became an attractive alternative in its own right.

This Note documents RAND's research that led to the mathematical specification for the robust method. It should be of interest to the Air Force members of the EFMP who are building the EFMS. It should also be of interest to modelers and analysts who are involved in manpower and personnel research for the uniformed services. This specification was presented to the Air Force as one possible solution to the problem of predicting the short-term behavior of airmen. The Air Force is using this and other specifications as the point of departure for developing a method for predicting the monthly losses of enlisted personnel in Module 1 of SAM. As a consequence, the version of Module 1 that will be used in the EFMS is likely to differ considerably from that presented in this Note.

The work described here is part of the Enlisted Force Management Project (EFMP), a joint effort of the Air Force (through the Deputy Chief of Staff for Personnel) and RAND. RAND's work falls within the Resource Management Program of Project AIR FORCE. The EFMP is part of a larger body of work in that program concerned with the effective utilization of human resources in the Air Force.

SUMMARY

The Short-Term Aggregate Inventory Projection Model (SAM) is one component of the Enlisted Force Management System (EFMS). SAM makes monthly projections (for the rest of the current fiscal year) of the aggregate force (the total enlisted force across all specialties). SAM can be used to analyze the total size, grade composition, and budget cost of the enlisted force during a fiscal year. It supports planning of management actions to achieve user-specified end-of-year force levels (known as "end strengths") and user-specified end-of-year grade levels (known as "grade strengths").

The SAM model contains five modules:

Module P: Preprocessor
Module 1: Separation Projection
Module 2: Inventory and Cost Projection
Module 3: Computer Aided Design
Module 4: Plan Comparison

Module 1 (the Separation Projection module) predicts "policy-free" monthly losses and reenlistments of Air Force enlisted personnel for the rest of the current fiscal year. "Policy-free" means that the predictions assume zero early releases and zero early reenlistments caused by actions of enlisted force managers. The robust separation projection method is one way of predicting the separations required from Module 1.

The predictions are inputs to Module 2 of SAM, which adds the effects of early release and early reenlistment programs (and other management actions) to convert the predictions of policy-free losses and reenlistments into predictions of actual losses and reenlistments. The robust separation projection method uses data on past losses and reenlistments to estimate separation rates for a model that predicts policy-free loss and reenlistment flows one month at a time for each of a mutually exclusive set of about 500 cohorts. After these flows are predicted for a projection month, the inventory is updated and the models are applied to the updated inventories to predict the flows for the following month. This process is repeated until the inventory for

the last month of the fiscal year is projected. Thus, it applies a series of separation rates to different inventories.

ACKNOWLEDGMENTS

Many people contributed to the analysis presented herein.

Much research by many people in the Air Force and at RAND underlie the robust separation projection method. In general, the Air Force concentrated on issues related to database creation and testing the model; RAND concentrated on the mathematical specifications.

The Washington Area Personnel Systems Division of the Air Force Military Personnel Center (AFMPC/DPMDW) provided a sounding board for the development and prepared the datasets on which the model test runs were based. Colonels Robert Walker and James Sampson coordinated our numerous requests for help; Captain Kevin Lawson provided detailed knowledge of data files and Air Force regulations; and Captain Perryn Ashmore took final responsibility for preparing and delivering the necessary data files.

RAND colleagues Warren Walker, Grace Carter, and Michael Murray provided guidance and advice over a perioa of several years. The models grew out of forecasting work begun by Jan Chaiken and Captain Joseph Adams (DPMDW). Allan Abrahamse, William Mickelson, and Warren Walker provided helpful comments in reviewing earlier drafts of this work.

ACRONYMS AND ABBREVIATIONS

AFSC	Air Force Specialty Code
ARIMA	Auto-Regressive Integrated Moving Average (type of time-series model)
CAT	Category of enlistment (first-term, second-term, career-term, retirement eligible)
CATENLST	Category of enlistment (same as CAT)
DOEYRMO	Date of current enlistment--year, month
DOSYRMO	Date of separation--year,month
EFMS	Enlisted Force Management System
ETS	Expiration of term-of-service
ETSYRMO	Expiration of term-of-service--year, month
FY	Fiscal year
GRADE	Pay grade
INV	Inventory at beginning of month
IPM	Inventory Projection Model
LATR	Attrition loss indicator
LETS	ETS loss indicator
METS	Months to end of term of service
MIT	Month in term
MOS	Month of service
PDGL	Promotion/Demotion Gain Loss (file)
REUP	Reenlistment indicator
SABL	Seasonal Adjustment Bell Labs
SAM	Short-term Aggregate Inventory Projection Model
SAM1	Module in SAM that estimates policy-free separations and performs policy-free inventory projections
SPD	Separation Program Designator
SPDTRCD	General category of transaction (loss, reenlistment, etc.)
SSAN	Social Security Number
TAFMSD	Date of total active federal military service--year, month, day
TAFMSDYM	Date of total active federal military service--year, month
TOE	Term of enlistment (number of years (4 or 6) of enlisted obligation)
TERMENLT	Term of enlistment (same as TOE)
UAR	Uniform Airman Record (file)
USAF	United States Air Force
XLEN	Extension status (yes or no, short or long)
YOS	Years of service
YRMO	Date of the file--year, month

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I. INTRODUCTION

The Short-term Aggregate Inventory Projection Model (SAM) is the component of the Air Force Enlisted Force Management System (EFMS) that provides one- to twelve-month projections for the aggregate force (across all specialties). It will be used to analyze the size, grade composition, and cost of the enlisted force during a fiscal year and supports the planning of management actions designed to achieve fiscal-year goals for total force strength, force strength by the top five grades, and personnel costs.

SAM consists of five modules:

- SAMP--data preparation preprocessor.
- SAM1--separation and inventory projection.
- SAM2--inventory and cost projection.
- SAM3--computer-aided design of management actions.
- SAM4--plan comparison.

This Note describes Module 1 of SAM (SAM1). Rydell and Lawson (1991a) provide an overview of SAM and detailed descriptions of the other four modules.

PURPOSE OF SAM1

SAM1 forecasts flows of enlisted airmen. For each month, it estimates how many airmen reenlist, are lost, or simply continue in their terms. It divides losses into two types: attrition (not fulfilling contractual commitments), and expiration of term-of-service (ETS) losses (fulfilling contractual commitments).

SAM1 tracks inventories, losses, and reenlistments, by grade. It generates "baseline" forecasts of behavioral, as opposed to policy-driven, airman decisions. If special programs are implemented to drive airmen out of the service early, the data input to SAM1 are adjusted to reflect loss behavior as if the policy had not been in place, and the module works off the adjusted data.

The Air Force needs such a model to carry out force planning. Congress mandates the number of airmen and their levels as of the end of the fiscal year (September 30). Missing those targets in either direction is costly: Budgets may be overrun or end-strength may be insufficient to carry out the Air Force's mission.

SUPPORTING RESEARCH

SAM1 implements ideas that developed at RAND over a five-year period beginning around 1982, including several specific forecasting models, plus the framework for chaining them together. Much of the structure of SAM1 is the result of the knowledge gained from fitting those models.

The initial set of forecasting models was developed using a methodology developed by Box and Jenkins (1970). These models use a mutually exclusive list of about 500 airman classes and predict for each class what fraction of airmen will be lost or will reenlist in each future month. Thus, the models move the airman classes ahead one month at at time. The models implicitly specify rules for who moves ahead to where; e.g., 46 or more months into the first term, an airman is eligible to reenlist, move ahead to month 47, in certain circumstances fulfill his or her contractual obligations, or attrit. The functional forms of the models vary considerably among classes. There is a diverse mixture of autoregressive models and moving average models.

The Box-Jenkins models are quite complex, requiring great effort to maintain. SAM1 should produce accurate forecasts and should be maintainable with as little effort as possible. So alternative forecasting models were considered with the intent of contrasting them on maintainability as well as performance.

Autoregressive models are really conditional expectation models: Known past information is used to forecast average future information. In the simplest case, take the average of some of the past data as the forecast. This would smooth fluctuations in the data and yield an estimate of future values. How much of past data should be used to calculate the average? Should all past data have equal weight? Maybe

data from the distant past is not as relevant as more recent data. Exponential smoothing is a forecasting technique that uses continually decreasing weights to average the data from the present into the past. If the coefficients of the forecast decrease very slowly, then large amounts of past data contribute to the forecast and the exponential smoothing forecast is almost equivalent to a simple running average. If they decrease quickly, then the forecast is determined almost exclusively by recent experience.

The main problem with averages is that they are greatly influenced by extreme values. A very large past value of the data will increase the average, thus increasing the forecast of the future. When the data fluctuate widely, the median or middle value is often used instead of the average because it is less influenced by either large or small outliers. This observation leads to a class of forecasting models called *robust models*, which use well-known methods of robust linear regression and medians to extract trend and seasonal effects from each series in ways that are not sensitive to outliers.

Box-Jenkins models, running average models, and robust models provide three independent ways for SAM1 to produce its estimates. The Air Force is conducting an extensive test and evaluation to determine which type of model it will use in the EFMS. Documentation for the Box-Jenkins models can be found in Brauner, Lawson, and Mickelson (1991). Running average models are the basis of the Benchmark Separation Projection model, documented by Rydell and Lawson (1991b). This Note documents the robust models.

OUTPUTS FROM SAM1

SAM1 projects attrition, policy-free ETS losses, retirements, reenlistments, and flows to retirement eligibility up to 12 months into the future. It starts with actual inventory counts in each of about 500 airman classes; then, for each month, it determines the number of each type of transition from within each class.

The classes of airmen are defined by the following attributes:

- CAT--category of enlistment (first term, second term, career, retirement eligible).
- TOE--term of enlistment (4 or 6 years).
- MOS--month of service (1, 2, 3, ...).
- METS--months to ETS (48, 47, ..., 0, -1, ..).
- MIT--month in term (1, 2, ...).
- XLEN--extension status (yes or no, short or long).
- YOS--years of service.

Transitions can be one of four types:

- Loss to attrition.
- Loss to expiration of term of service.
- Reenlistment.
- Simple aging into the next class.

Given these transition counts, SAM1 updates the size and composition of the airman classes, summarizes certain features of that month's transitions, then moves on to the next month.

Output from SAM1 becomes input to SAM2, which projects monthly inventories and fiscal-year costs conditional upon user choices of management actions (such as early releases) that control the shape of the enlisted force over time.

ORGANIZATION

Section II describes the types of databases that supported the development and testing of SAM1, what was done with these data, and how they guided the development of the module. Section III describes how SAM1 works. In addition to airman counts, input to SAM1 includes a set of loss and reenlistment models. Section IV describes the robust models. Results from testing the robust models are discussed in Sec. V.

II. DATA FOR FITTING AND TESTING

A dataset was needed on which SAM1 could be tested and debugged. RAND did not have the knowledge to build the final working dataset, nor did it have the responsibility of keeping it current in day-to-day operations. For these reasons, RAND built a test dataset with enough features to support implementation, testing, and development. The Air Force has prepared the dataset for the operational model.

INFORMATION SOURCES

Both the test dataset and the Air Force dataset were constructed with data from two monthly airman-level files maintained by the Air Force: the "Uniform Airman Record" (UAR) file, and the "Promotion, Demotion, Gain, Loss" (PDGL) file. The UAR contains inventory information at the end of the month, and the PDGL contains information on transactions that occurred during the month. With one record for every airman in the force, the UAR contains about 500,000 records per month; the PDGL contains about 30,000 records per month, with sometimes more than one record per airman per month. These data were available to us for the months from February 1983 through September 1987.

Tables 1 and 2 list the relevant variables available from each source. Each record contains a certain amount of demographic information (e.g., whether the airman finished high school, race, age, sex), plus information describing the airman's status in the force. All of the variables listed in the tables were needed to classify airmen into the modeling categories.

DATA PROCESSING REQUIREMENTS

Unpublished RAND research on the Enlisted Force Management Project by Joseph Adams and Jan Chaiken had identified homogeneous groups of airmen within which fairly constant loss and reenlistment behavior can be expected. Table 3 shows the variables required to produce these groupings, along with the variables to be aggregated.

Table 1

UAR VARIABLES USED TO CREATE DATASET FOR SAM1

Variable	Description
CATENLST	Category of enlistment codes: 1 = first-term airman 2 = second-term airman 4 = career airman 5 = E-9 or E-9 selectee with high-year of tenure waived blank or 9 = unknown
DOSYRMO	Date of separation--year,month Example: 8707
DOEYRMO	Date of current enlistment--year, month For first-term airmen, DOEYRMO usually = TAFMSDYM. For second- and career-term airmen, DOEYRMO is the date the current term began.
ETSYRMO	Expiration of term of service--year, month
GRADE	Pay grade
SSAN	Social Security number
TAFMSDYM	Date of Total Active Federal Military Service--year, month. The date the airman entered U.S. military service (not necessarily the Air Force).
TERMENLT	Term of enlistment The number of years for which an individual voluntarily enters into a USAF component.
YRMO	Date of the file--year, month

Table 2

PDGL VARIABLES USED TO CREATE DATASET FOR SAM1

Variable	Description
CATENLST	Category of enlistment code 1 = first-term airman 2 = second-term airman 4 = career airman 5 = E-9 or E-9 selectee with high-year of tenure waived blank or 9 = unknown
GRADE	Pay grade
SSAN	Social Security number
SPDTRCD	This variable identifies the general category of the transaction (gain, loss, reenlistment, or extension) and specific type of transaction within each category. The general groupings are 010 = non-prior service accession 020 = prior service accession 030 = gain for officer training school 040-055 = miscellaneous gain 100-160 = reenlistment 170 = extension 200 = promotion 210 = demotion 300-310 = retirement loss 400 = loss to officer training school 410,600-610 = miscellaneous loss 500-520,645-655 = expiration of term-of-service loss 615-625 = palace chase loss 630-640 = early release loss 700-840 = attrition loss other = unknown
TAFMSD	Date of Total Active Federal Military Service--year,month,day
TERMENLT	Term of enlistment The number of years for which an individual voluntarily enters into a USAF component.
YRMO	Date of the file--year, month

Table 3

VARIABLES NEEDED TO PRODUCE SAM1 CROSSTABULATION CATEGORIES

Variable	Description
Grouping Variables	
GRADE	Pay grade--taken as the GRADE on the UAR or PDGL
CAT	Category of enlistment--computed from CATENLST on the UAR or PDGL 1 = first-term airman 2 = second-term airman 3 = career airman 4 = retirement eligible
TOE	Term of enlistment--taken as TERMENLT on the UAR or PDGL
MOS	Month of service--computed as the difference between now and the date of total active military service (TAFMSDYM or TAFMSD)
METS	Months to ETS--difference between now and ETSYRMO
MIT	Months in term (first term only)--computed as a function of TOE and METS
XLEN	Extension length (first term only) 0 = currently on a <12 month extension 1 = currently on a ≥12 month extension -99 = not currently on extension
Aggregation Variables	
INV	In inventory at beginning of month--present on the UAR now, or present on the UAR the previous month
LATR	Attrition loss indicator--recoded from transaction category variable SPDTRCD (on the PDGL)
LETS	ETS loss indicator--recoded from transaction category variable SPDTRCD (on the PDGL)
REUP	Reenlistment indicator--recoded from transaction category variable SPDTRCD (on the PDGL)

To satisfy the requirements of SAM1, it was not sufficient simply to build airman-month level variables and do a crosstabulation. First, policy effects had to be removed from the data. During certain recent time periods, select groups (e.g., groups approaching their expiration of term of service) had been singled out for early-release programs at different times. Because SAM1 makes baseline projections (projections assuming no policy intervention), it is necessary to remove these program effects from the dataset. Special codes in the PDGL file indicate who left because of early-release programs: The data were modified to pretend that these airman were in the force until their originally scheduled ETS date. It was therefore necessary to link an airman's records across time, then work through his longitudinal history to modify his records. This added greatly to the complexity of the data recoding algorithms. It also greatly increased the amount of data processing: Instead of passing each monthly file individually, the data for all months had to be sorted and merged at the airman level.

Errors in the data posed additional problems. The UAR and PDGL files are known to have several unedited fields, which would require a fair amount of cleaning to correct. The files are created to produce simple monthly reports, and these reports (or the use to which they are put) are not sensitive to occasional errors. SAM1, however, required cleaner files than that. Errors in dates or enlistment categories caused irreconcilable counts from month to month. For example, if errors in one month produced an overcount that was corrected by the next month, it was not possible to discern why the counts changed. Was it unexpected losses or correction of errors? The data contained numerous stray codes that required Air Force personnel expertise to resolve. RAND's strategy was to rely on the fact that errors in data items tend to be corrected the following month. When an airman's entire longitudinal history was input, valid data could be identified by sweeping through all months and accepting values that were consistent over time.

The data processing algorithms were developed through a long series of iterations. The first iteration derived airman characteristics and reviewed many airmen on an individual basis. Subsequent iterations attempted to correct identified problems, verify their resolution, and then produce additional airman records to see what other problems remained. The goal was to achieve internal consistency: UAR and PDGL records tended to have numerous inconsistencies, but it was unlikely that the same inconsistency would persist for a given airman over time (e.g., three consecutive values of category of enlistment might be (4,2,4), in which case the 2 would be changed to a 4).

The process ultimately converged, and a dataset was built upon which many of the final modeling decisions were based. These files have been superseded by files built by the Air Force.

III. STRUCTURE OF SAM1

SAM1 is implemented in a FORTRAN program. The program moves each group of airmen forward one month at a time. At each time point, some fraction of the group is lost, some fraction reenlists, and the rest of the group is aged. The model has a Markovian flavor in the sense that, given the transition probabilities, the number of airmen in a given state at time $t+1$ depends only on the inventory at time t. However, the transition probabilities at each time depend on more than just the most recent observations, so the model is not strictly Markovian.

MODELING ENVIRONMENT

Several considerations guided development of SAM1. First, RAND research had identified homogeneous groups of airmen within which fairly constant loss and reenlistment behavior was expected. Also, SAM1's output had to satisfy explicit requirements. Additional modules of SAM had already been designed to display, aggregate, edit, and further analyze SAM1's output. These modules had been designed to supply Air Force personnel managers with the information they wanted and needed. SAM1 was also expected to provide inputs to a Middle-Term Disaggregate Inventory Projection Model:[1] This specified a different level of detail. Finally, the intention to validate the models on data that had not been used in the models' development implied that the models could change, so there was a need not to hard-wire specific models into SAM1, but to allow change.

In view of these considerations, several design decisions were made at an early date.

- Choices of homogeneous groups were made, dependent on

[1]Unpublished RAND research by Joseph Cafarella, Grace Carter, Jan Eakle-Cardinal, Robert Houchens, C. Peter Rydell, and Warren Walker.

- CAT--Category of enlistment (first-term, second-term, career-term, retirement eligible).
- TOE--Term of enlistment (4 or 6 years).
- MOS--Month of service (first and retirement terms only).
- METS--Months to ETS.
- MIT--Month in term.
- XLEN--Extension status.
- YOS--Years of service.

- The time interval for projection was taken to be one month. No limit was imposed on the number of months SAM1 might forecast over. That would be an input to the program.
- The time period for model fitting (FY74-FY83) was kept separate from the time period for testing (FY84 and beyond).
- The model had to run easily on an IBM 4381 computer (the EFMS computer). Execution time to project 12 months could be no more than 2 hours, and the model would have to fit within about 8 megabytes of memory.
- SAM1 had to be easily modified to permit testing different types of models. The Box-Jenkins forecasting models contained many parameters and would require a great deal of effort to maintain. The plan was to test some simpler models, such as running average models, to see how much (if any) precision was gained by the additional complexity.
- The data examined were not stable. Plots of various series showed abrupt shifts in loss and reenlistment rates. SAM1 had to be designed to operate in an environment where such shifts, whether due to policy changes or to changes in the nature of available data, were an expected phenomenon.
- Air Force policies keep changing. For example, ETS losses could occur anywhere within a year of ETS for the entire period when the modeling occurred, whereas a recent decision allows them only during the last three months of that year. SAM1 had to be designed to produce reasonable projections in the face of such changes.

LOGIC OF SAM1

SAM1 requires

- A set of rules for mapping grouping variables into homogeneous groups known as cohorts.
- A set of rules for aging cohorts over their Air Force careers.
- Recent counts of inventory, losses due to attrition, ETS losses, and reenlistments, by grade.
- A set of models for estimating loss and reenlistment rates.

SAM1 takes each cohort and ages it one month, using the loss rates and reenlistment rates provided by the models. After SAM1 cycles through the entire set of cohort indices for a given month, the characteristics of the cohorts are updated (MOS is increased by 1, METS is decreased by 1, reenlistments are sent into the next category of enlistment, etc.). Finally, certain statistics summarizing that month are generated, and SAM1 moves on to the next month.

Figures 1 and 2 show the types of transitions that airmen can make as they move through the force. For simplicity, the figures consider only 4-year terms of enlistment; nevertheless, they show about 200 states in the first, second, and career terms, and about 150 states for the latter part of the career term and the retirement eligible years.

Airmen enter from the civilian labor force, and progress through their first term, occupying each state for one month. At any point, they can move forward in that term, or they can reenter the civilian labor force through attrition. At a certain point in the term, the number of choices increases by two: Airmen can reenlist, or they can fulfill their contractual obligations and become ETS losses. If they reenlist, they follow a similar path in the second and career terms.

The complete set of cohort definitions allowed is shown in Table 4. Each combination of CAT, TOE, MOS, METS, MIT, and XLEN is crossed with all applicable YOS values. While about 420 combinations of categories are indicated in the table, crossing the categories with YOS yields about 1,000 combinations.

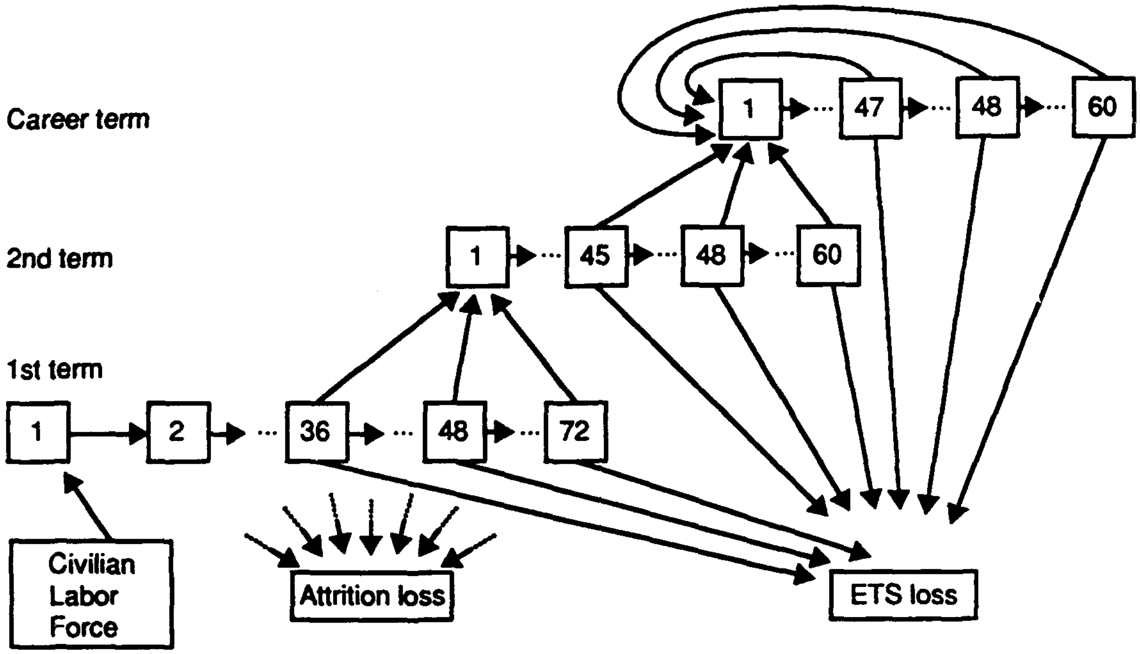

Fig. 1--Transition types by month in term:
1st, 2d, and career terms (4-year term of enlistment)

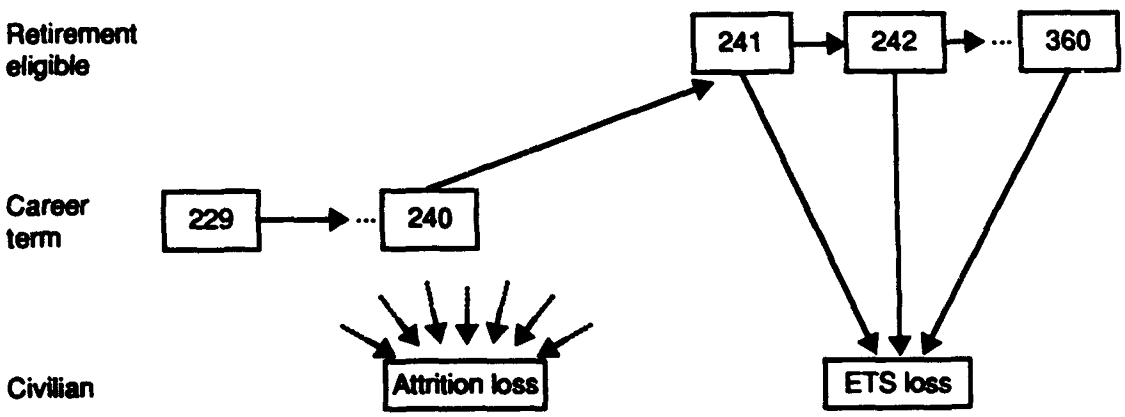

Fig. 2--Transition types by months of service:
Career term and retirement eligibles

Table 4

AIRMAN COHORTS USED IN SAM1

CAT	TOE	MOS	METS	MIT	XLEN	YOS
1	4	-99	48	1	-99	0
1	4	-99	47	2	-99	0
			..	..		
1	4	-99	13	36	-99	2
1	4	-99	12	37	-99	3
1	4	-99	12	37	0	3
1	4	-99	12	37	1	3
1	4	-99	11	38	-99	3
			..	..	..	
1	4	-99	<-22	72	-99	5
1	4	-99	<-22	72	0	5
1	4	-99	<-22	72	1	5
1	6	-99	72	1	-99	0
1	6	-99	71	2	-99	0
			..	..		
1	6	-99	13	60	-99	4
1	6	-99	12	61	-99	5
1	6	-99	12	61	0	5
1	6	-99	12	61	1	5
1	6	-99	11	62	-99	5
			..	..	..	
1	6	-99	<-22	96	-99	7
1	6	-99	<-22	96	0	7
1	6	-99	<-22	96	1	7
2	4	-99	-99	-99	-99	all
2	4	-99	15	-99	-99	all
2	4	-99	..	-99	-99	all
2	4	-99	<-11	-99	-99	all
2	6	-99	-99	-99	-99	all
2	6	-99	15	-99	-99	all
2	6	-99	..	..	-99	all
2	6	-99	<-11	-99	-99	all
3	4	-99	-99	-99	-99	all
3	4	-99	12	-99	-99	all
3	4	-99	11	-99	-99	all
			..	..		all
3	4	-99	<-11	-99	-99	all
3	4	229	-99	-99	-99	all
3	4	230	-99	-99	-99	all
3	4	...	-99	-99	-99	all
3	4	239	-99	-99	-99	all
3	4	240	-99	-99	-99	all
3	6	-99	-99	-99	-99	all
3	6	-99	12	-99	-99	all
3	6	-99	11	-99	-99	all
			..	..		all
3	6	-99	<-11	-99	-99	all
3	6	229	-99	-99	-99	all
3	6	230	-99	-99	-99	all
3	6	231	-99	-99	-99	all
3	6	...	-99	-99	-99	all
3	6	237	-99	-99	-99	all
3	6	238	-99	-99	-99	all
3	6	239	-99	-99	-99	all
3	6	240	-99	-99	-99	all
4	-99	241	-99	-99	-99	all
4	-99	242	-99	-99	-99	all
		...				all
4	-99	>359	-99	-99	-99	all

NOTES: CAT = 3 indicates career term, 4 indicates retirement eligible.
CAT = -99 indicates category not used to define the cohort.

AIRMAN COUNTS AND TRANSITION RATES

SAM1 needs inventory counts to know how many airmen to project forward. If, in addition, the transition probabilities were known for flows between states, it would be possible to predict the size of the force perfectly. It is these transition probabilities that have to be estimated.

Section II described how the airman inventory, loss, and reenlistment counts were obtained. These counts are essentially crosstabulations of airmen by grade versus the above combinations of indices. The major modification to the counts was an attempt to "put back" those airmen who were lost to early release programs or required to reenlist early. The inventory adjustments assume these airmen are in the force until their contract separation date and that the appropriate ETS loss or reenlistment occurs on that date. Even this method is only an approximation to what would have occurred had the early release program not been in effect. An airman who was forced to choose to reenlist or leave early could have made a different choice or attritted if allowed to remain in the Air Force until his ETS.

Time series methods were used to estimate transition probabilities. The types of time series formed are indicated in Fig. 3. In this case, the probabilities are those relating to first-term airmen in their 46th month of service. Each airman position was isolated, and the transition rates out of that position over the time period FY74 through FY87 were examined. Figures 4 and 5 show some typical time series so formed. Figure 4 is the time series of attrition losses for first-term airmen in their second month of service. Figure 5 is the time series of attrition losses for first-term airmen in their third month of service. The former series seems to be fairly stable, but the latter contains a shift in average behavior in FY84. Time series like these form the basis of the modeling activity, as described below.

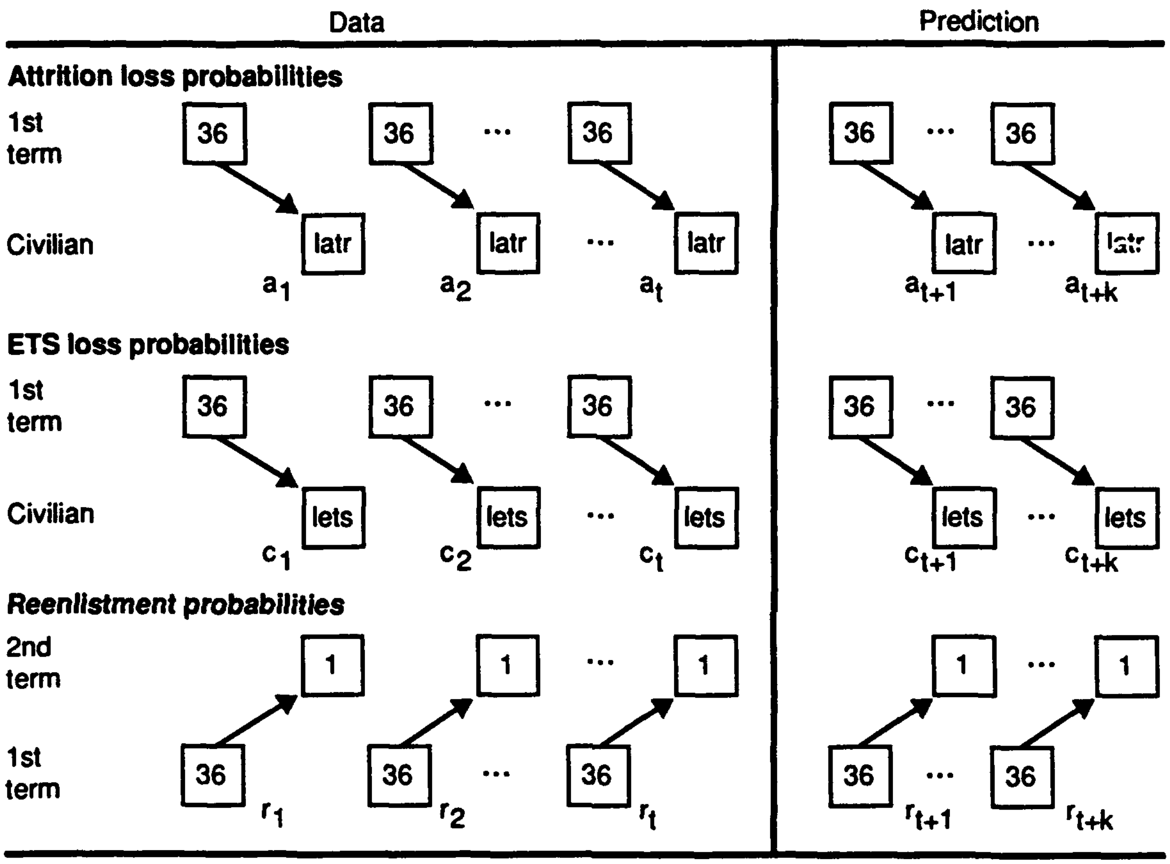

Fig. 3--Time series formed for predicting transition probability for 1st term airmen in month of service 36

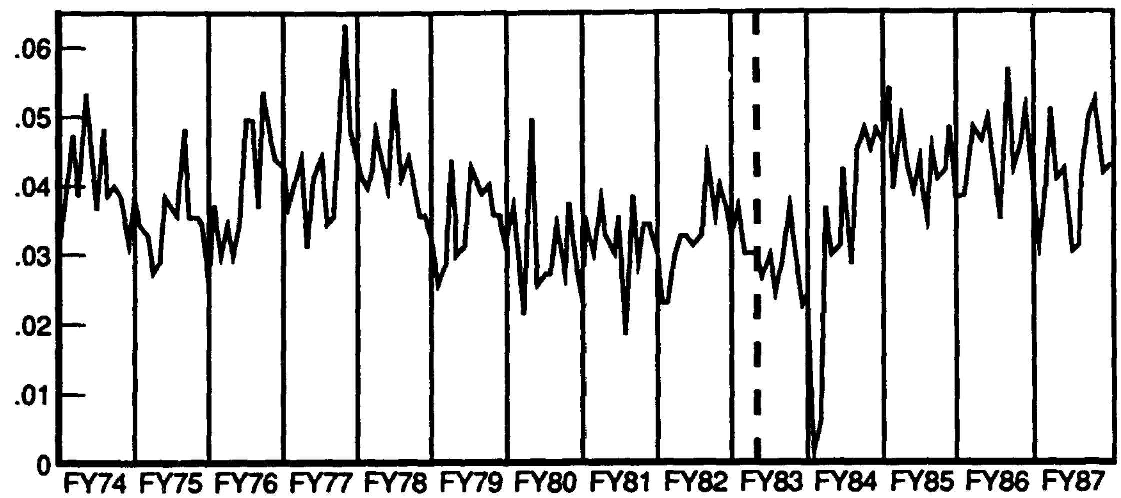

Fig. 4--Raw data: Losses due to attrition,
1st term airmen in month of service 2

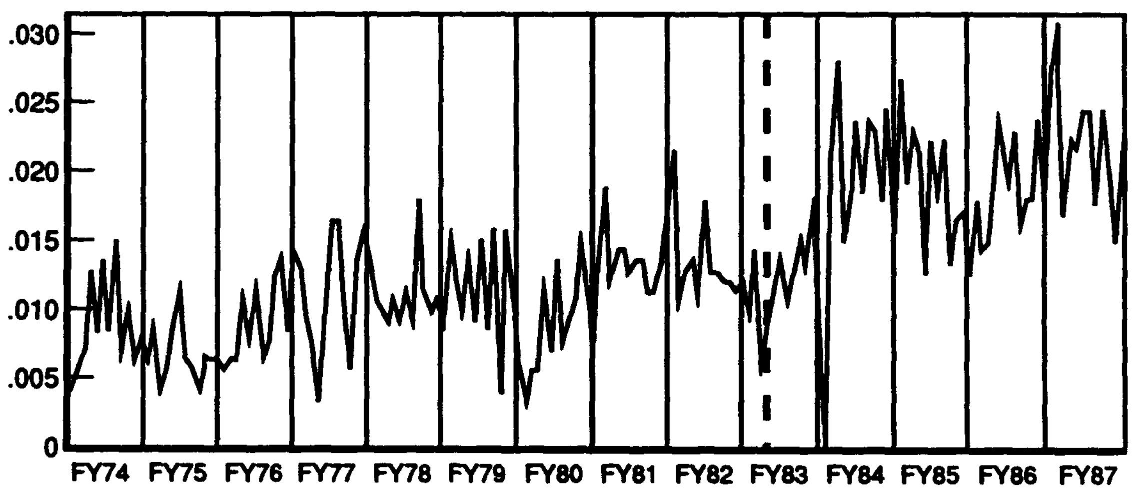

Fig. 5--Raw data: Losses due to attrition,
1st term airmen in month of service 3

IV. THE ROBUST MODELS

The approach uses robust methods of statistics to decompose a series as

$$x_t = m_t + s_t + r_t$$

where

x_t = the loss/reenlistment rate at time t.

m_t = the trend.

s_t = the seasonal effect.

r_t = the residual component.

It operates by subjecting the series to several filters, each of which operates on a moving window of points. The filters are robust in the sense that they are not greatly affected by one or two outliers.

The robust method consists of the following nine steps:

1. Smooth the data with 12-month moving medians. The 12-month window is wide enough to avoid seasonal effects, and the medians are insensitive to outliers.
2. Smooth the moving medians with moving averages. Because the effects of outliers were eliminated through the moving medians, using moving averages will not cause a problem here. These two fits have eliminated 12 points from each end; these are added back in Step 8.
3. Compute the residuals of the raw data with respect to the moving average fit from Step 2.
4. Group these residuals by month of year: Regard the January residuals as their own time series, similarly for the other months.
5. Fit medians to each of the 12 monthly series from Step 4.

6. Calculate final estimates of monthly effects by smoothing these medians using averages over adjacent months.
7. Subtract these monthly effects from the original series; this presumably deseasonalizes the data.
8. Regress the deseasonalized data on time (using robust regression methods) and use predicted values to extend the deseasonalized series forward and backward 12 months. This produces a deseasonalized series over the same time frame as the original series. Robust regression methods downweight outlying values to guard against their distorting the fits: Compare Cleveland, 1979.
9. Assume for projection purposes that recent slopes in trends will flatten out.[1] Thus, project the last fitted trend point (say, at time T) forward, and add the estimated seasonal effects to extrapolate to the next fiscal year.

$$x_{T+1} = m_T + s_{T-11}$$

$$\ldots$$

$$x_{T+12} = m_T + s_T$$

The next section contains data series for several airman classes with one-year robust extrapolations added to their end. It graphically shows the effects of the algorithm and compares its performance with those of the other methods using the test dataset constructed at RAND.

---

[1]Indeed, if one looks at a plot of loss or reenlistment rates over time, the series trends tend to fluctuate up and down without predictable cycle lengths.

V. TEST AND EVALUATION OF THE ROBUST MODELS

The performance of the models was examined on two levels: the micro level (Figs. 6-9), and the aggregate level (Tables 5 and 6). At the micro-level, the extrapolated probabilities were checked for reasonable values by simply looking at graphs of projections. At the aggregate level, forecast inventories one year out were compared with actual values.

MICRO-LEVEL RESULTS

The micro-level comparisons focus on transition rates for the approximately 500 classes of airmen. Figures 6-9 display actual data (spiked lines) and fitted trend (curves) for FY84–FY87 for four airman classes. Projected transition rates are shown in the last panel for FY88 using robust models (labeled R), the Box-Jenkins models fit on data from July 1974 through June 1983 (labeled B), and 3-month running average models (labeled A). These four particular airman classes were chosen because they represent the range of observed patterns and comparisons.

Figures 6 and 7 show attrition losses for first-term airmen in months of service 2 and 3. The robust model predicts the trend and the seasonality best of the three methods. Figure 8 shows that there was a large outlier in mid-FY87 for reenlistment rates. This did not affect the accuracy of the robust model projections but would have caused the running average model to forecast reenlistment rates that were much too high toward the end of FY87. Figure 9 demonstrates the inability of the Box-Jenkins models to adapt to a change in the level of the transition probabilities between the time period used for fitting the models and that in which the models are applied. In sum, the robust models look fairly reasonable and certainly appear best among these three candidates for these particular series. This behavior was typical of other series as well.

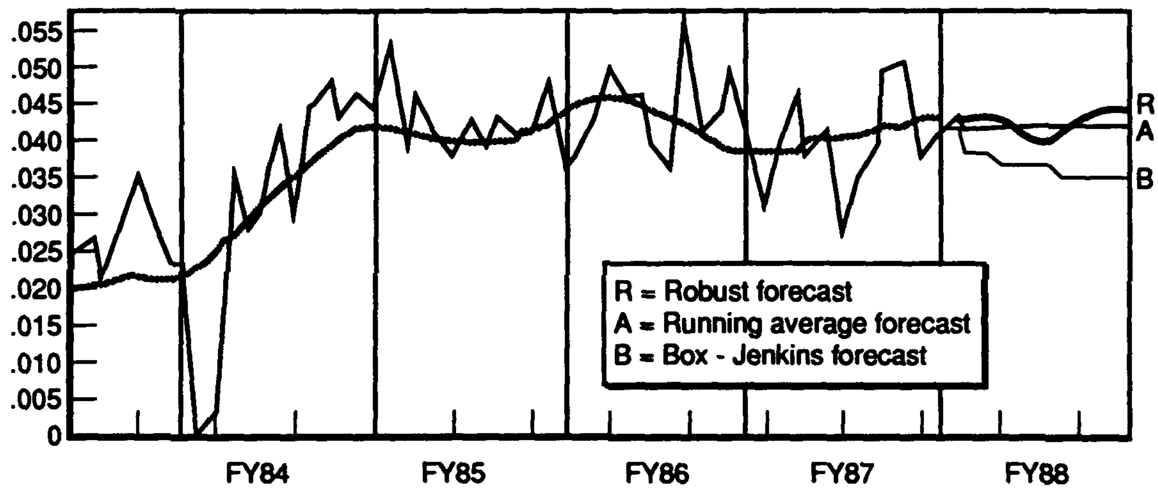

Fig. 6--Attrition loss rate, 1st term airmen in month of service 2

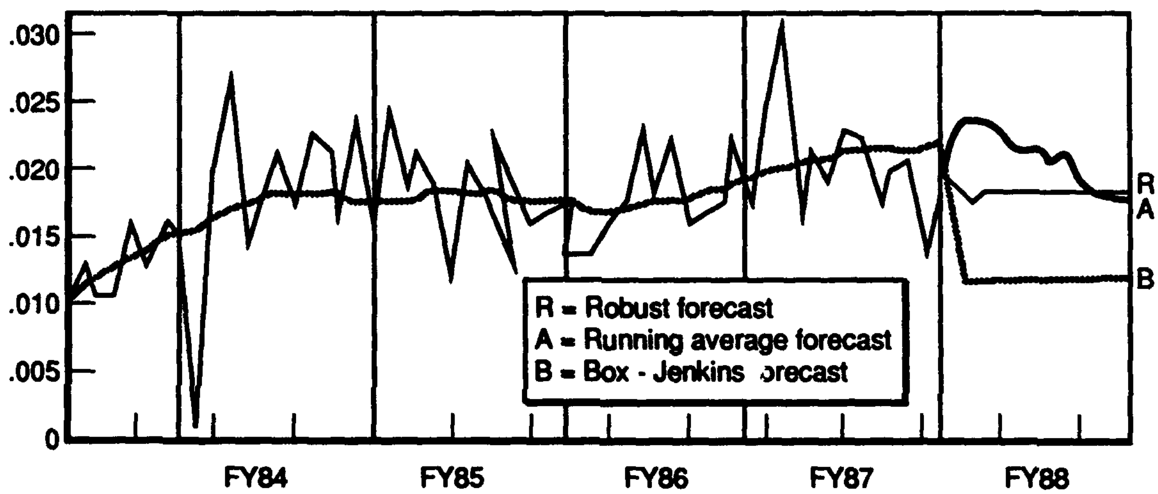

Fig. 7--Attrition loss rate, 1st term airmen in month of service 3

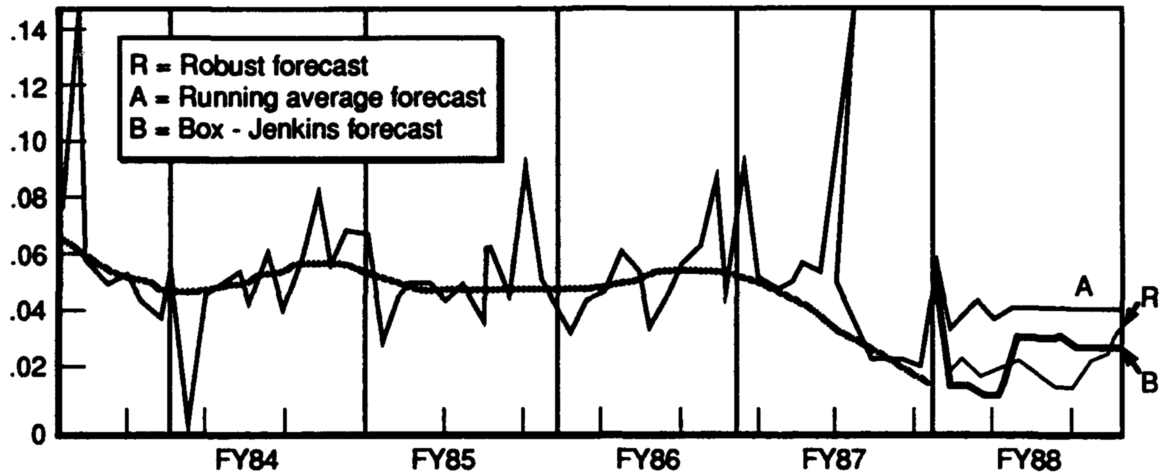

Fig. 8--Reenlistment rate, 1st term airmen in month of service 48

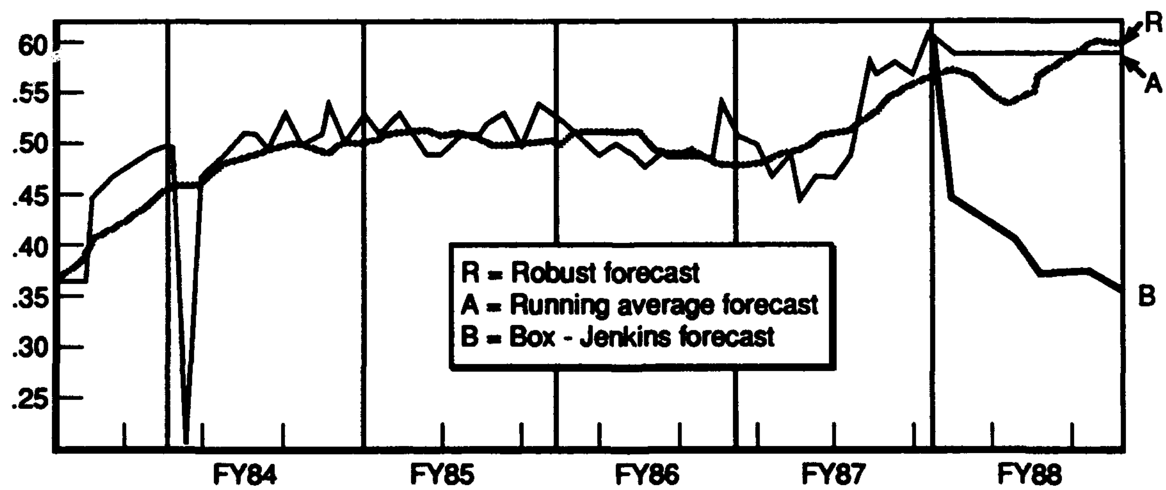

Fig. 9--ETS loss rate, 1st term airmen in month of service 49

AGGREGATE-LEVEL RESULTS

The aggregate-level results focus on total inventory by category of enlistment. Other aggregations could be considered, such as counts of people by grade and year of service. The decision was made to concentrate on category of enlistment aggregations because they would be fairly free of policy effects (recall that SAM1 tries to forecast in a "policy fre environment"). Also, published statistics of actual counts were used for comparison. The robust model picks up several unobvious trends that are not simply straight-line projections from the previous year. Much of the force behavior is predictable: The majority of airmen simply age by one month. The rates at which they are lost or reenlist are fairly stable over time, so errors in predicting those rates do not have a major effect on the aggregate inventory projections.

The remainder of this section discusses the results of tests of the robust models using a dataset provided to RAND by the Air Force in April 1989. For each month in the period October 1987 through September 1988, inventory, losses, and reenlistments were projected forward, to the end of the fiscal year (FY87 or FY88). The predictions were compared with actuals. The appendix contains the complete set of actual and predicted values, along with their actual and percentage differences. This section summarizes the full fiscal year forecasts (the ones that used October as the start date) and the half-year forecasts (the ones that used April as the start date).

The results of the test are not simple to interpret. Ideally, comparisons of actual and predicted values should indicate random variation. Large discrepancies between the actual and predicted values would signal possible model misspecification. But the actual data values are quite sensitive to policy actions that increase or decrease loss and reenlistment rates.[1] The test results contain some of these policy effects, and there is no simple way to disentangle them all.

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[1]The policy-free adjustments affect only the timing of losses. The net effect of the early release programs is to accelerate (and perhaps increase or decrease) losses.

Despite this, through years of major changes in the inventories, the model stayed well within or close to 1 percent error for all categories of enlistment with one exception, and that exception can be traced to a policy effect.

Percentage errors in predicting losses and reenlistments are much larger than for inventories. They are generally within 10 percent. For the purposes for which SAM was built, producing accurate inventory projections is much more important than producing accurate predictions of losses and reenlistments.

Inventory Projections

The results of inventory projection are shown in Table 5. Under the "actual" column, the inventory at the end of the fiscal year is shown. Then there are two alternative predictions of that end-of-year inventory: SAM1's prediction for that entire year (M-1) and SAM1's prediction for the last half of the year (M-1/2) given the actual data for the first half of the year. The percentage error (two columns on the right) tell the *main* story.

Table 5

END-OF-FISCAL-YEAR INVENTORY

CATENLST	Fiscal Year	Actual Inventory	Projected Inventory M-1	Projected Inventory M-1/2	Percentage Error M-1	Percentage Error M-1/2
all	1987	95640	494487	496480	-.2	.2
all	1988	481117	482205	481633	.2	.1
1st	1987	220501	221950	221545	.7	.5
1st	1988	201189	202547	200560	.7	-.3
2d	1987	118380	116748	118414	-1.4	.0
2d	1988	118613	117796	118129	-.7	-.4
career	1987	134736	133671	134416	-.8	-.2
career	1988	138692	138244	139585	-.3	.6
retirement	1987	22023	22117	22105	.4	.4
retirement	1988	22623	23617	23359	4.4	3.3

Except for the retirement term in FY88, SAM1 forecasts have small percentage errors across the board, despite fairly large changes in the inventories from one year to the next. The FY88 discrepancy can be traced to exceptionally high retirement losses during the last two months of that fiscal year. During that period, early retirement was encouraged through waiver of commitments. An airman could retire early in his current grade and receive credit for having completed his obligation in that grade.

Reenlistment and Loss Projections

Table 6 shows how SAM1 performed in estimating counts of each of the three kinds of transitions: attrition losses (attr), ETS losses (ets), and reenlistments (reup). Cases in which the errors are larger than 10 percent are flagged and discussed in the footnotes.

To understand SAM1's predictive ability, first recall how SAM1 works. SAM1 moves numerous cohorts forward one month at a time. At each time point, some fraction of the cohort is lost, some fraction reenlists, and the rest of the cohort is aged; also, new cohorts with one month of service are "accessed." For a given position in the force (e.g., 1st term, 4-year term of enlistment, 37 months of service), the transition rates are based on 3- to 4-year time series of other cohorts' experiences while in that same position.

SAM1's predictive ability results from three things.

- The observed errors are conditional on having the right accessions information. SAM1 uses this information.
- Transition rates tend to be reasonably stable over time.
- Distance to ETS explains much of the variation in transition rates, and SAM1 keeps track of all cohorts' positions relative to ETS. For example, when SAM1 sees when a large wave of airmen approaching ETS, it has no trouble predicting a large number of transitions.

Table 6

TRANSITION COUNT PROJECTIONS

CATENL	Fiscal Year	Type of Trans	Actual	Prediction M-1	Prediction M-1/2	Percentage Error M-1	Percentage Error M-1/2
all	1987	attr	22246	23566	21935	6.2	-1.4
	1987	ets	35414	35417	35164	.1	-.7
	1987	reup	67748	69309	68800	2.4	1.6
	1988	attr	20009	20704	21489	3.5	7.4
	1988	ets	37690	36192	35693	-3.9	-5.3
	1988	reup	71826	69871	74269	-2.8	3.4
1st	1987	attr	16940	17221	16619	1.8	-1.9
	1987	ets	20587	20683	20156	.5	-2.1
	1987	reup	25201	24834	25639	-1.3	1.7
	1988	attr	14872	15589	15792	4.7	6.2
	1988	ets	20793	20696	20051	-.5	-3.6
	1988	reup	25120	24872	26391	-1.0	5.1
2d	1987	attr	3619	4225	3508	17.4[a]	-3.1
	1987	ets	4849	4911	5039	1.3	3.9
	1987	reup	17506	17772	17652	1.6	.8
	1988	attr	3325	3545	3824	6.9	15.0[b]
	1988	ets	4825	4421	4333	-8.2	-10.2
	1988	reup	18587	18236	19217	-1.9	3.4
career	1987	attr	1629	2084	1763	28.9[c]	8.2
	1987	ets	808	733	864	-9.3	6.9
	1987	reup	20097	21879	20602	8.8	2.5
	1988	attr	1785	1531	1848	-13.8[d]	3.5
	1988	ets	898	918	876	2.6	-2.4
	1988	reup	22750	21351	23103	-6.3	1.6
retire	1987	attr	58	36	45	-37.9[e]	-22.4[e]
	1987	ets	9170	9091	9104	-.9	-.7
	1987	reup	4944	4825	4906	-2.4	-.8
	1988	attr	27	40	24	48.1[e]	-11.1[e]
	1988	ets	11174	10157	10434	-9.1	-6.6
	1988	reup	5369	5412	5559	.8	3.5

[a]Drop in 2d-term attrition during all of FY87.

[b]Upward shift in 2d-term attrition during last half of FY88.

[c]Downward shift in career attrition, but small base (errors in neighborhood of 30 per month).

[d]Upward shift in career attrition, but small base (errors in neighborhood of 20 per month).

[e]Very small bases (ACTUAL = 58 or 27).

The main requirement for SAM1 to do well is that there are no abrupt changes in transition rates. For example, SAM1's biggest error--the FY88 retirement term--can be traced to exceptionally high retirement losses during the last two months of that fiscal year.

CONSIDERATIONS FOR FURTHER TESTING AND EVALUATION

The input data files for any of the proposed projection models should be carefully studied for anomalies before they are used in any program. This subsection provides examples of data problems encountered in attempting to create a dataset used to compare the performance of the alternative SAM1 models.

In the original dataset, the number of airmen increased dramatically in one month (by almost 4000) with no historical verification of such an event. In another month the count jumped by more than 2000, and then went down by another 2000 several months later. Those jumps are too large to be correct.

In FY87, several thousand records appeared in the PDGL files to account for AFSC changes. But the code that indicated the type of transaction was not properly initialized in the program that generated the test dataset, so the program counted several thousand more losses and reenlistments than actually occurred.

The data were also contaminated by policy interventions whose effects are hard to identify and remove. For example, reenlistments were affected by three "reup or get out" policies, one in July 1985, another in September 1986, and a third in April 1987. These policies not only sent positive shocks into the reenlistment rates series but affected loss rates as well (the extension option is removed, except for some airmen serving overseas, so airmen approaching ETS are seen to exit from the service at higher than normal rates). For example, the months immediately following the April 1987 policy had exceptionally high ETS loss rates. Probably some airmen who normally would have extended through the end of the fiscal year showed up as ETS losses.

Once the data files have been checked and inventory projections obtained, caution must still be exercised. Just because one set of plots looks more reasonable than another does not guarantee that the better-looking plots identify a better model. Abrupt shifts can occur in the series naturally, or the series may be contaminated by policy changes, which a bad model can capture by accident. For example, if a point in the series just before the projection period happens to be a large positive outlier, and the actual data during the projection period have shifted upward as well, the running-average models will predict quite well. A simple comparison of actual and predicted data may not be conclusive.

The Air Force will continue to perform test and evaluation on the robust and benchmark separation projection models. Unfortunately, errors in prediction cannot be isolated to model misspecification only. Policy actions will continue to affect the data, and the data will continue to exhibit certain unexplained shocks. Nevertheless, this exercise will provide further understanding of the operating characteristics of SAM1 and the alternative loss and reenlistment models.

Appendix

INVENTORIES AND PREDICTION ERRORS THROUGH END OF FISCAL YEAR

SAM was designed to provide short term forecasts in a dynamic environment. It must be able to predict changes in the force as the year unfolds. Air Force personnel planners need monthly force projections at the beginning of the fiscal year as well as projections during the year. The tables in this appendix are presented for reference purposes, to help gauge how accurate these models are compared with others that personnel planners might be considering. These tables show actual and projected inventories, losses, and reenlistments beginning in October for an entire fiscal year and beginning in each subsequent month for the remainder of the fiscal year. The two fiscal years that were used in this exercise are 1987 and 1988.

For predictions of total inventory after losses, the percentage error over all categories of enlistment rounded to zero. When inventories were predicted for first-term airmen, second-term airmen, and career airmen, the error was 2 percent or less. Only the predictions for the inventory in the retirement term showed larger percentage errors. The errors of 4 percent, 5 percent, and 6 percent in the August and September 1988 forecasts were the result of a retirement policy change that could not be predicted.

The Air Force is primarily concerned with predicting accurate inventories. But accurate inventory prediction results from correctly predicting losses and reenlistments. Thus, the prediction of attrition, ETS, retirement losses, and reenlistments was also analyzed. The percentage errors in these predictions were generally much larger than for the inventory predictions, ranging from 0 to 29 percent. The larger errors result primarily because small numbers are more difficult to accurately predict than large numbers. It is still important to perform this verification, allowing for larger errors but looking for extreme outliers and patterns that would indicate data and/or forecasting errors.

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
		Prediction Month											
Inventories After Losses: All Categories of Enlistment, 1987													
OCT	Actual (A)	499280	499015	497999	499321	500701	499804	499120	497705	497026	496314	496463	495640
APR								499120	497705	497026	496314	496463	495640
OCT	Predicted (P)	497737	498961	497631	498529	499338	498471	497765	496111	495514	494763	494969	494487
APR								499166	497561	497038	496358	496686	496480
OCT	Error (A-P)	-1543	-54	-368	-792	-1363	-1333	-1355	-1594	-1512	-1551	-1494	-1153
APR								46	-144	12	44	223	840
OCT	Pct Error:	0	0	0	0	0	0	0	0	0	0	0	0
APR	100*(P-A)/A							0	0	0	0	0	0
Inventories After Losses: All Categories of Enlistment, 1988													
OCT	Actual (A)	497086	495439	494334	494538	493661	492339	491685	490227	488484	486029	483603	481117
APR								491685	490227	488484	486029	483603	481117
OCT	Predicted (P)	495921	495622	494831	495014	494098	492907	492143	490507	488384	486192	484114	482205
APR								491453	489746	487583	485374	483341	481633
OCT	Error (A-P)	-1165	183	497	476	437	568	458	280	-100	163	511	1088
APR								-232	-481	-901	-655	-262	516
OCT	Pct Error:	0	0	0	0	0	0	0	0	0	0	0	0
APR	100*(P-A)/A							0	0	0	0	0	0
Inventories After Losses: First-Term Airmen, 1987													
OCT	Actual (A)	228737	229376	227761	228419	229011	227968	226154	222875	221566	220856	221059	220501
APR								226154	222875	221566	220856	221059	220501
OCT	Predicted (P)	228762	229758	228135	228570	228907	227906	226500	224283	223253	222342	222406	221950
APR								226401	224026	222879	221882	221935	221545
OCT	Error (A-P)	25	382	374	151	-104	-62	346	1408	1687	1486	1347	1449
APR								247	1151	1313	1026	876	1044
OCT	Pct Error:	0	0	0	0	0	0	0	1	1	1	1	1
APR	100*(P-A)/A							0	1	1	0	0	0

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Inventories After Losses: First-Term Airmen, 1988													
OCT	Actual (A)	220200	219510	218317	217938	216296	214394	212217	208899	206496	204467	202814	201189
APR								212217	208899	206496	204467	202814	201189
OCT	Predicted (P)	220328	219964	218936	218590	217065	215266	213700	211351	208750	206229	204214	202547
APR								212309	209729	206963	204310	202211	200560
OCT	Error (A-P)	128	454	619	652	769	872	1483	2452	2254	1762	1400	1358
APR								92	830	467	-157	-603	-629
OCT	Pct Error:	0	0	0	0	0	0	1	1	1	1	1	1
APR	100*(P-A)/A							0	0	0	0	0	0
Inventories After Losses: Second-Term Airmen, 1987													
OCT	Actual (A)	119307	118574	118568	118446	118674	118325	118079	118810	119025	118778	118569	118380
APR								118079	118810	119025	118778	118569	118380
OCT	Predicted (P)	118873	118721	118460	118098	118025	117578	116808	116806	116864	116888	116805	116748
APR								117997	118102	118261	118365	118360	118414
OCT	Error (A-P)	-434	147	-108	-348	-649	-747	-1271	-2004	-2161	-1890	-1764	-1632
APR								-82	-708	-764	-413	-209	34
OCT	Pct Error:	0	0	0	0	-1	-1	-1	-2	-2	-2	-1	-1
APR	100*(P-A)/A							0	-1	-1	0	0	0
Inventories After Losses: Second-Term Airmen, 1988													
OCT	Actual (A)	119106	118324	118083	118259	117832	118103	118255	118752	118843	118774	118721	118613
APR								118255	118752	118843	118774	118721	118613
OCT	Predicted (P)	118763	118544	118503	118520	117839	118081	118237	118408	118421	118243	118066	117796
APR								118110	118342	118408	118285	118245	118129
OCT	Error (A-P)	-343	220	420	261	7	-22	-18	-344	-422	-531	-655	-817
APR								-145	-410	-435	-489	-476	-484
OCT	Pct Error:	0	0	0	0	0	0	0	0	0	0	-1	-1
APR	100*(P-A)/A							0	0	0	0	0	0

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Inventories After Losses: Career-Term Airmen, 1987													
OCT	Actual (A)	129890	129923	130512	131297	131796	132093	133327	134281	134629	134578	134824	134736
APR								133327	134281	134629	134578	134824	134736
OCT	Predicted (P)	128561	129114	129827	130673	131124	131539	132944	133408	133770	133655	133748	133671
APR								133248	133798	134236	134190	134377	134416
OCT	Error (A-P)	-1329	-809	-685	-624	-672	-554	-383	-873	-859	-923	-1076	-1065
APR								-79	-483	-393	-388	-447	-320
OCT	Pct Error:	-1	-1	-1	0	-1	0	0	-1	-1	-1	-1	-1
APR	100*(P-A)/A							0	0	0	0	0	0
Inventories After Losses: Career-Term Airmen, 1988													
OCT	Actual (A)	135857	135588	135696	136029	137119	137140	138298	139464	139734	139725	139279	138692
APR								138298	139464	139734	139725	139279	138692
OCT	Predicted (P)	134774	135017	135249	135597	136665	136769	137237	137688	138061	138592	138430	138244
APR								138177	138762	139240	139853	139741	139585
OCT	Error (A-P)	-1083	-571	-447	-432	-454	-371	-1061	-1776	-1673	-1133	-849	-448
APR								-121	-702	-494	128	462	893
OCT	Pct Error:	-1	0	0	0	0	0	-1	-1	-1	-1	-1	0
APR	100*(P-A)/A							0	-1	0	0	0	1
Inventories After Losses: Retirement-Term Airmen, 1987													
OCT	Actual (A)	21346	21142	21158	21159	21220	21418	21560	21739	21806	22102	22011	22023
APR								21560	21739	21806	22102	22011	22023
OCT	Predicted (P)	21541	21368	21210	21189	21282	21448	21514	21613	21628	21879	22010	22117
APR								21520	21635	21661	21920	22015	22105
OCT	Error (A-P)	195	226	52	30	62	30	-46	-126	-178	-223	-1	94
APR								-40	-104	-145	-182	4	82
OCT	Pct Error:	1	1	0	0	0	0	0	-1	-1	-1	0	0
APR	100*(P-A)/A							0	0	-1	-1	0	0

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	Prediction Month OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
Inventories After Losses: Retirement-Term Airmen, 1988														
OCT	Actual (A)	21923	22017	22238	22312	22414	22702	22915	23112	23411	23063	22789	22623	
APR								22915	23112	23411	23063	22789	22623	
OCT	Predicted (P)	22055	22098	22143	22307	22529	22790	22969	23060	23153	23128	23404	23617	
APR								22857	22913	22973	22926	23145	23359	
OCT	Error (A-P)	132	81	-95	-5	115	88	54	-52	-258	65	615	994	
APR								-58	-199	-438	-137	356	736	
OCT	Pct Error: 100*(P-A)/A	1	0	0	0	1	0	0	0	-1	0	3	4	
APR								0	-1	-2	-1	2	3	
Attrition Losses: All Categories of Enlistment, 1987														
OCT	Actual (A)	1738	1858	1825	1581	1569	1974	2100	1705	2122	1777	1880	2117	22246
APR								2100	1705	2122	1777	1880	2117	11701
OCT	Predicted (P)	1935	1944	1869	1909	1979	2030	1959	1975	2018	1987	1975	2056	23636
APR								1857	1902	1957	1933	1862	1879	11390
OCT	Error (A-P)	197	86	44	328	410	56	-141	270	-104	210	95	-61	1390
APR								-243	197	-165	156	-18	-238	-311
OCT	Pct Error: 100*(P-A)/A	11	5	2	21	26	3	-7	16	-5	12	5	-3	6
APR								-12	12	-8	9	-1	-11	-3
Attrition Losses: All Categories of Enlistment, 1988														
OCT	Actual (A)	1961	1562	2077	1438	1622	1798	1574	1641	1684	1548	1582	1522	20009
APR								1574	1641	1684	1548	1582	1522	9551
OCT	Predicted (P)	1807	1707	1610	1679	1716	1674	1765	1777	1739	1727	1750	1756	20707
APR								1899	1887	1857	1824	1812	1752	11031
OCT	Error (A-P)	-154	145	-467	241	94	-124	191	136	55	179	168	234	698
APR								325	246	173	276	230	230	1480
OCT	Pct Error: 100*(P-A)/A	-8	9	-22	17	6	-7	12	8	3	12	11	15	3
APR								21	15	10	18	15	15	15

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	OCT	NCV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
		Prediction Month												
Attrition Losses: First-Term Airmen, 1987														
OCT	Actual (A)	1296	1458	1425	1190	1243	1536	1588	1270	1616	1316	1388	1614	16940
APR								1588	1270	1616	1316	1388	1614	8792
OCT	Predicted (P)	1392	1417	1338	1393	1463	1498	1425	1435	1472	1448	1447	1523	17251
APR								1392	1417	1453	1422	1373	1414	8471
OCT	Error (A-P)	96	-41	-87	203	220	-38	-163	165	-144	132	59	-91	311
APR								-196	147	-163	106	-15	-200	-321
OCT	Pct Error:	7	-3	-6	17	18	-2	-10	13	-9	10	4	-6	2
APR	100*(P-A)/A							-12	12	-10	8	-1	-12	-4
Attrition Losses: First-Term Airmen, 1988														
OCT	Actual (A)	1475	1182	1591	1045	1259	1351	1164	1234	1256	1098	1138	1079	14872
APR								1164	1234	1256	1098	1138	1079	6969
OCT	Predicted (P)	1402	1318	1241	1311	1323	1267	1334	1317	1266	1254	1266	1275	15574
APR								1392	1359	1317	1288	1285	1248	7889
OCT	Error (A-P)	-73	136	-350	266	64	-84	170	83	10	156	128	196	702
APR								228	125	61	190	147	169	920
OCT	Pct Error:	-5	12	-22	25	5	-6	15	7	1	14	11	18	5
APR	100*(P-A)/A							20	10	5	17	13	16	13
Attrition Losses: Second-Term Airmen, 1987														
OCT	Actual (A)	296	269	274	273	212	291	350	303	344	312	337	358	3619
APR								350	303	344	312	337	358	2004
OCT	Predicted (P)	371	356	361	346	344	355	359	356	361	354	345	341	4249
APR								307	313	327	331	317	298	1893
OCT	Error (A-P)	75	87	87	73	132	64	9	53	17	42	8	-17	630
APR								-43	10	-17	19	-20	-60	-111
OCT	Pct Error:	25	32	32	27	62	22	2	18	5	13	2	-5	17
APR	100*(P-A)/A							-12	3	-5	6	-6	-17	-6

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	Prediction Month OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
Attrition Losses: Second-Term Airmen, 1988														
OCT	Actual (A)	329	251	330	252	242	280	260	263	285	282	282	269	3325
APR								260	263	285	282	282	269	1641
OCT	Predicted (P)	281	272	256	252	271	282	295	318	329	330	335	334	3555
APR								345	359	372	367	354	344	2141
OCT	Error (A-P)	-48	21	-74	0	29	2	35	55	44	48	53	65	230
APR								85	96	87	85	72	75	500
OCT	Pct Error:	-14	8	-22	0	12	1	13	21	15	17	19	24	7
APR	100*(P-A)/A							33	37	30	30	25	28	30
Attrition Losses: Career-Term Airmen, 1987														
OCT	Actual (A)	139	129	121	113	107	142	154	126	160	144	151	143	1629
APR								154	126	160	144	151	143	878
OCT	Predicted (P)	168	166	166	167	169	174	173	182	182	182	181	190	2100
APR								156	169	175	178	169	164	1011
OCT	Error (A-P)	29	37	45	54	62	32	19	56	22	38	30	47	471
APR								2	43	15	34	18	21	133
OCT	Pct Error:	21	29	37	48	58	23	12	44	14	27	20	33	29
APR	100*(P-A)/A							1	34	9	24	12	15	15
Attrition Losses: Career-Term Airmen, 1988														
OCT	Actual (A)	155	127	154	136	121	163	148	144	141	161	161	174	1785
APR								148	144	141	161	161	174	929
OCT	Predicted (P)	120	113	110	112	117	121	131	139	141	141	148	145	1538
APR								161	167	166	167	172	160	993
OCT	Error (A-P)	-35	-14	-44	-24	-4	-42	-17	-5	0	-20	-13	-29	-247
APR								13	23	25	6	11	-14	64
OCT	Pct Error:	-23	-11	-29	-18	-3	-26	-11	-4	0	-12	-8	-17	-14
APR	100*(P-A)/A							9	16	18	3	7	-8	7

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
		Prediction Month												
Attrition Losses: Retirement-Term Airmen, 1987														
OCT	Actual (A)	7	2	5	5	7	5	8	6	2	5	4	2	58
APR								8	6	2	5	4	2	27
OCT	Predicted (P)	4	4	4	3	3	3	3	3	3	3	2	2	37
APR								2	3	2	2	2	2	13
OCT	Error (A-P)	-3	2	-1	-2	-4	-2	-5	-3	1	-2	-2	0	-21
APR								-6	-3	0	-3	-2	0	-14
OCT APR	Pct Error: 100*(P-A)/A	Note: Base too small (<100) for percentage errors to be meaningful.												
Attrition Losses: Retirement-Term Airmen, 1988														
OCT	Actual (A)	2	2	2	5	0	4	2	0	2	7	1	0	27
APR								2	0	2	7	1	0	12
OCT	Predicted (P)	3	3	4	4	5	5	4	4	3	2	2	2	41
APR								1	2	2	2	1	1	9
OCT	Error (A-P)	1	1	2	-1	5	1	2	4	1	-5	1	2	14
APR								-1	2	0	-5	0	1	-3
OCT APR	Pct Error: 100*(P-A)/A	Note: Base too small (<100) for percentage errors to be meaningful.												
Policy-Free ETS Losses: All Categories of Enlistment, 1987														
OCT	Actual (A)	2026	2009	2071	2037	1852	2612	2012	2291	2162	2425	2225	2524	26246
APR								2012	2291	2162	2425	2225	2524	13639
OCT	Predicted (P)	2074	2065	2098	2099	1997	2477	2076	2145	2224	2370	2302	2416	26343
APR								2136	2183	2228	2357	2252	2296	13452
OCT	Error (A-P)	48	56	27	62	145	-135	64	-146	62	-55	77	-108	97
APR								124	-108	66	-68	27	-228	-187
OCT	Pct Error:	2	3	1	3	8	-5	3	-6	3	-2	3	-4	0
APR	100*(P-A)/A							6	-5	3	-3	1	-9	-1

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	Prediction Month OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
Policy-Free ETS Losses: All Categories of Enlistment, 1988														
OCT	Actual (A)	1890	1854	2151	2291	1858	2197	2198	2248	2289	2582	2306	2653	26517
APR								2198	2248	2289	2582	2306	2653	14276
OCT	Predicted (P)	1919	1948	2124	2201	1978	2157	2135	2241	2372	2337	2321	2314	26047
APR								2088	2163	2262	2233	2156	2116	13018
OCT	Error (A-P)	29	94	-27	-90	120	-40	-63	-7	83	-245	15	-339	-470
APR								-110	-85	-27	-349	-150	-537	-1258
OCT	Pct Error:	2	5	-1	-4	6	-2	-3	0	4	-9	1	-13	-2
APR	100*(P-A)/A							-5	-4	-1	-14	-6	-20	-9
Policy-Free ETS Losses: First-Term Airmen, 1987														
OCT	Actual (A)	1616	1591	1594	1610	1438	1824	1624	1871	1730	1905	1757	2029	20589
APR								1624	1871	1730	1905	1757	2029	10916
OCT	Predicted (P)	1643	1625	1619	1676	1557	1794	1646	1716	1775	1879	1828	1939	20697
APR								1657	1702	1735	1821	1752	1817	10484
OCT	Error (A-P)	27	34	25	66	119	-30	22	-155	45	-26	71	-90	108
APR								33	-169	5	-84	-5	-212	-432
OCT	Pct Error:	2	2	2	4	8	-2	1	-8	3	-1	4	-4	1
APR	100*(P-A)/A							2	-9	0	-4	0	-10	-4
Policy-Free ETS Losses: First-Term Airmen, 1988														
OCT	Actual (A)	1491	1481	1748	1751	1495	1683	1779	1764	1746	2029	1785	2042	20794
APR								1779	1764	1746	2029	1785	2042	11145
OCT	Predicted (P)	1509	1550	1728	1699	1591	1721	1739	1806	1874	1860	1829	1792	20698
APR								1720	1763	1795	1788	1704	1633	10403
OCT	Error (A-P)	18	69	-20	-52	96	38	-40	42	128	-169	44	-250	-96
APR								-59	-1	49	-241	-81	-409	-742
OCT	Pct Error:	1	5	-1	-3	6	2	-2	2	7	-8	2	-12	0
APR	100*(P-A)/A							-3	0	3	-12	-5	-20	-7

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	Prediction Month OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
Policy-Free ETS Losses: Second-Term Airmen, 1987														
OCT	Actual (A)	342	352	404	381	352	721	326	357	355	436	400	423	4849
APR								326	357	355	436	400	423	2297
OCT	Predicted (P)	378	387	430	375	386	620	370	363	378	420	403	405	4915
APR								403	401	406	451	420	405	2486
OCT	Error (A-P)	36	35	26	-6	34	-101	44	6	23	-16	3	-18	66
APR								77	44	51	15	20	-18	189
OCT	Pct Error:	11	10	6	-2	10	-14	13	2	6	-4	1	-4	1
APR	100*(P-A)/A							24	12	14	3	5	-4	8
Policy-Free ETS Losses: Second-Term Airmen, 1988														
OCT	Actual (A)	330	318	333	455	310	435	361	417	481	467	433	485	4825
APR								361	417	481	467	433	485	2644
OCT	Predicted (P)	331	325	322	409	322	370	323	360	419	399	408	439	4427
APR								297	325	390	370	373	397	2152
OCT	Error (A-P)	1	7	-11	-46	12	-65	-38	-57	-62	-68	-25	-46	-398
APR								-64	-92	-91	-97	-60	-88	-492
OCT	Pct Error:	0	2	-3	-10	4	-15	-11	-14	-13	-15	-6	-10	-8
APR	100*(P-A)/A							-18	-22	-19	-21	-14	-18	-19
Policy-Free ETS Losses: Career-Term Airmen, 1987														
OCT	Actual (A)	68	66	73	46	62	67	62	63	77	84	68	72	808
APR								62	63	77	84	68	72	426
OCT	Predicted (P)	53	53	49	48	53	63	61	66	71	72	71	73	733
APR								76	80	87	85	80	74	482
OCT	Error (A-P)	-15	-13	-24	2	-9	-4	-1	3	-6	-12	3	1	-75
APR								14	17	10	1	12	2	56
OCT	Pct Error:	Note: Base too small (<100) for percentage errors to be meaningful.												
APR	100*(P-A)/A													

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
		Prediction Month												
Policy-Free ETS Losses: Career-Term Airmen, 1988														
OCT	Actual (A)	69	55	70	85	53	79	58	67	62	86	88	126	898
APR								58	67	62	86	88	126	487
OCT	Predicted (P)	79	72	74	93	65	66	73	75	79	79	84	83	922
APR								71	76	77	75	79	86	464
OCT	Error (A-P)	10	17	4	8	12	-13	15	8	17	-7	-4	-43	24
APR								13	9	15	-11	-9	-40	-23
OCT APR	Pct Error: 100*(P-A)/A	Note: Base too small (<100) for percentage errors to be meaningful.												
Retirement Losses, 1987														
OCT	Actual (A)	1137	827	519	560	665	553	489	492	628	900	1227	1173	9170
APR								489	492	628	900	1227	1173	4909
OCT	Predicted (P)	943	793	694	582	635	590	569	575	685	942	1005	1077	9090
APR								533	562	670	937	1045	1097	4844
OCT	Error (A-P)	-194	-34	175	22	-30	37	80	83	57	42	-222	-96	-80
APR								44	70	42	37	-182	-76	-65
OCT	Pct Error:	-17	-4	34	4	-5	7	16	17	9	5	-18	-8	-1
APR	100*(P-A)/A							9	14	7	4	-15	-6	-1
Retirement Losses, 1988														
OCT	Actual (A)	1167	858	651	773	809	646	592	499	561	1275	1695	1648	11174
APR								592	499	561	1275	1695	1648	6270
OCT	Predicted (P)	1032	906	828	690	681	670	623	601	765	954	1145	1263	10158
APR								649	639	798	978	1202	1263	5529
OCT	Error (A-P)	-135	48	177	-83	-128	24	31	102	204	-321	-550	-385	-1016
APR								57	140	237	-297	-493	-385	-741
OCT	Pct Error:	-12	6	27	-11	-16	4	5	20	36	-25	-32	-23	-9
APR	100*(P-A)/A							10	28	42	-23	-29	-23	-12

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
		Prediction Month												
Reenlistments: All Categories of Enlistment, 1987														
OCT	Actual (A)	5449	5049	5454	5045	4855	6461	7069	5405	5618	6115	5295	5933	67748
APR								7069	5405	5618	6115	5295	5933	35435
OCT	Predicted (P)	5435	5509	5628	5404	5353	6653	5631	5670	5867	6174	5993	6041	69358
APR								5934	5928	6088	6421	6146	5970	36487
OCT	Error (A-P)	-14	460	174	359	498	192	-1438	265	249	59	698	108	1610
APR								-1135	523	470	306	851	37	1052
OCT	Pct Error:	0	9	3	7	10	3	-20	5	4	1	13	2	2
APR	100*(P-A)/A							-16	10	8	5	16	1	3
Reenlistments: All Categories of Enlistment, 1988														
OCT	Actual (A)	5741	4612	5847	6509	5370	7482	7244	5996	5732	5627	5682	5985	71827
APR								7244	5996	5732	5627	5682	5985	36266
OCT	Predicted (P)	5202	5075	5415	6337	5296	5749	5744	6011	6378	6061	6167	6385	69820
APR								6361	6476	6802	6323	6317	6429	38708
OCT	Error (A-P)	-539	463	-432	-172	-74	-1733	-1500	15	646	434	485	400	-2007
APR								-883	480	1070	696	635	444	2442
OCT	Pct Error:	-9	10	-7	-3	-1	-23	-21	0	11	8	9	7	-3
APR	100*(P-A)/A							-12	8	19	12	11	7	7
Reenlistments: First-Term Airmen, 1987														
OCT	Actual (A)	2091	1803	1913	1997	1754	2408	3019	2097	1856	2049	1912	2302	25201
APR								3019	2097	1856	2049	1912	2302	13235
OCT	Predicted (P)	1988	1998	1984	2061	1941	2235	2108	2115	2133	2149	2061	2098	24871
APR								2298	2292	2302	2311	2226	2245	13674
OCT	Error (A-P)	-103	195	71	64	187	-173	-911	18	277	100	149	-204	-330
APR								-721	195	446	262	314	-57	439
OCT	Pct Error:	-5	11	4	3	11	-7	-30	1	15	5	8	-9	-1
APR	100*(P-A)/A							-24	9	24	13	16	-2	3

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
		Prediction Month												
Reenlistments: First-Term Airmen, 1988														
OCT	Actual (A)	1960	1518	2111	2178	2131	2724	3150	2054	1861	1850	1782	1802	25121
APR								3150	2054	1861	1850	1782	1802	12499
OCT	Predicted (P)	1757	1830	2089	2071	2121	2253	2210	2215	2234	2060	2023	1996	24859
APR								2442	2409	2404	2249	2194	2072	13770
OCT	Error (A-P)	-203	312	-22	-107	-10	-471	-940	161	373	210	241	194	-262
APR								-708	355	543	399	412	270	1271
OCT	Pct Error:	-10	21	-1	-5	0	-17	-30	8	20	11	14	11	-1
APR	100*(P-A)/A							-22	17	29	22	23	15	10
Reenlistments: Second-Term Airmen, 1987														
OCT	Actual (A)	1415	1372	1529	1347	1240	2026	1760	1274	1369	1567	1301	1306	17506
APR								1760	1274	1369	1567	1301	1306	8577
OCT	Predicted (P)	1397	1467	1626	1405	1412	2277	1390	1318	1336	1483	1372	1308	17791
APR								1479	1399	1416	1578	1468	1383	8723
OCT	Error (A-P)	-18	95	97	58	172	251	-370	44	-33	-84	71	2	285
APR								-281	125	47	11	167	77	146
OCT	Pct Error:	-1	7	6	4	14	12	-21	3	-2	-5	5	0	2
APR	100*(P-A)/A							-16	10	3	1	13	6	2
Reenlistments: Second-Term Airmen, 1988														
OCT	Actual (A)	1423	1197	1395	2132	1192	2075	2021	1395	1380	1377	1344	1656	18587
APR								2021	1395	1380	1377	1344	1656	9173
OCT	Predicted (P)	1380	1293	1411	2158	1228	1479	1362	1453	1684	1493	1520	1776	18237
APR								1526	1581	1790	1561	1570	1776	9804
OCT	Error (A-P)	-43	96	16	26	36	-596	-659	58	304	116	176	120	-350
APR								-495	186	410	184	226	120	631
OCT	Pct Error:	-3	8	1	1	3	-29	-33	4	22	8	13	7	-2
APR	100*(P-A)/A							-25	13	30	13	17	7	7

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
		Prediction Month												
Reenlistments: Career-Term Airmen, 1987														
OCT	Actual (A)	1495	1534	1677	1362	1553	1689	1952	1662	1889	1906	1596	1782	20097
APR								1952	1662	1889	1906	1596	1782	10787
OCT	Predicted (P)	1634	1664	1666	1614	1677	1814	1786	1858	1947	2057	2048	2108	21873
APR								1777	1828	1899	2026	1926	1835	11291
OCT	Error (A-P)	139	130	-11	252	124	125	-166	196	58	151	452	326	1776
APR								-175	166	10	120	330	53	504
OCT	Pct Error:	9	8	-1	19	8	7	-9	12	3	8	28	18	9
APR	100*(P-A)/A							-9	10	1	6	21	3	5
Reenlistments: Career-Term Airmen, 1988														
OCT	Actual (A)	1863	1558	1940	1832	1685	2266	1739	2077	1969	1867	1963	1991	22750
APR								1739	2077	1969	1867	1963	1991	11606
OCT	Predicted (P)	1613	1542	1535	1749	1584	1645	1776	1890	1958	1959	2038	2026	21315
APR								1952	1997	2080	1948	1960	2023	11960
OCT	Error (A-P)	-250	-16	-405	-83	-101	-621	37	-187	-11	92	75	35	-1435
APR								213	-80	111	81	-3	32	354
OCT	Pct Error:	-13	-1	-21	-5	-6	-27	2	-9	-1	5	4	2	-6
APR	100*(P-A)/A							12	-4	6	4	0	2	3
Reenlistments: Retirement-Term Airmen, 1987														
OCT	Actual (A)	448	340	335	339	308	338	338	372	504	593	486	543	4944
APR								338	372	504	593	486	543	2836
OCT	Predicted (P)	417	379	352	323	323	328	348	379	451	485	512	527	4824
APR								379	409	471	505	526	508	2798
OCT	Error (A-P)	-31	39	17	-16	15	-10	10	7	-53	-108	26	-16	-120
APR								41	37	-33	-88	40	-35	-38
OCT	Pct Error:	-7	12	5	-5	5	-3	3	2	-10	-18	5	-3	-2
APR	100*(P-A)/A							12	10	-6	-15	8	-7	-1

Projections Through End of Fiscal Year, by Start Month

Forecast Start	Type	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOT
		Prediction Month												
Reenlistments: Retirement-Term Airmen, 1988														
OCT	Actual (A)	495	339	401	367	362	417	334	470	522	533	593	536	5369
APR								334	470	522	533	593	536	2988
OCT	Predicted (P)	451	410	380	359	363	372	397	452	503	549	586	588	5410
APR								441	489	529	565	593	559	3176
OCT	Error (A-P)	-44	71	-21	-8	1	-45	63	-18	-19	16	-7	52	41
APR								107	19	7	32	0	23	188
OCT	Pct Error: 100*(P-A)/A	-9	21	-5	-2	0	-11	19	-4	-4	3	-1	10	1
APR								32	4	1	6	0	4	6

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